



# Checkups are fine. Our service is better



**One thing is for sure:** When you buy an on-load tap-changer from MR, you get the technically mature and sophisticated technology of the market leader in the field. Uncompromising quality and maximum reliability guaranteed. And you should ask for no less from our technical service. There is a specialist close to you wherever you are - round the world and round the clock. Trust him to find just the right solution for your problem. Why? Because he has the compiled know-how of MR's decades of experience right at his fingertips, plus the original data on every single OLTC ever delivered by MR! And above all: You can also trust us to provide competent assistance for OLTCs made by Siemens, AEG and TU.

**But that is not all.** Not only do we provide professional maintenance, but a range of engineering services as well. And we even train your service personnel: Either right at your premises or in one of our training centers in Germany and China.

You will find all details on our complete range of services on the pages to come. From maintenance to training all the way to a variety of service strategies. Interested? We'll be glad to send you an informative quotation. At the end of this brochure you will find our most important contact data. We'll be delighted to help you!



**Professional and qualified.** Professional workmanship, plenty of know-how, the right dash of improvisation skills and lots of hands-on experience - just the right mix to make our service specialists perfect for your tasks. Regular training up-grades and advanced training classes ensure our staff's continuous high-level competence. The best guarantee for a professional and state-of-the-art maintenance performance. And our specialists' know-how does not end at today's MR tap-changer type series. They are just as competent when it comes to older type tap-changers, MR license products, and OLTCs made by Siemens, AEG and TU.

**Fast.** What good does a prompt on-site diagnosis do if the spare most urgently needed is not available? But not to worry: In our spare parts warehouse we keep even seldom-used and unusual items on hand. And if there is still something missing, we'll just manufacture it on the spot. Installation is just as quick. Thanks to our worldwide service net we can have a specialist at your site in no time at all. Yet another safety milestone. Directly ex works, so to speak.

**First rate quality.** As a brand manufacturer we generally recommend the use of original MR spare parts. They are the number-one assurance for long and trouble-free function. None of our parts leaves MR without extensive prior quality testing. And you should demand the same quality in a professional installation and therefore count on our specialists.

**Warranty guaranteed.** We grant a 2-year warranty on all original MR spare parts as well as on all service and maintenance works performed by our specialists. Go for brand-name quality and see how well it pays off in the long run!

**Expert -certified.** Our technical service has been certified according to DIN EN ISO 9001 (Quality management), among others, as well as our management systems, that have been assessed and found to be in accordance with the requirements of the standards DIN EN ISO 9001:2000 and DIN EN ISO 14001:1996.



**Custom -tailored.** You tell us how much service you need. Whether it's a complete service package or a simple spare parts delivery - you will receive everything from a single source.





# The ABCs of Maintenance



## Maintenance yes - but when's the right time?

The two maintenance criteria of OLTCs are (a) the number of tap-change operations and (b) the time interval, whichever is reached first. These criteria differ in terms of type and application. The maintenance criteria for OLTCs equipped with an ED motor drive can be easily found on the information plate inside the housing door. To find the related data on the older model OLTCs, simply have a look at the user manual. If you have any further questions - we'll be delighted to help. All you need to do is tell us the serial number of your OLTC - it can be easily found on the name plate of the motor drive. And don't forget to tell us the current number of tap-change operations, which can be read off at the motor drive's counter.



Number of tap change operations displayed on the counter

OLTC serial number printed on the name plate (5- or 6-digit figure)

## What is included in a maintenance by MR?

- Disassembly and reassembly of the diverter switch insert
- Cleaning and inspection of the mechanics
- Visual check of the insulation distances of the diverter switch insert and oil compartment
- Parts replacement
- Exchange of the switching oil  
(fresh oil with a breakdown voltage > 50 kV/2.5 mm, in accordance with IEC 60156)
- Determination of the degree of contact wear
- Measuring of the transition resistors
- Inspection of motor drive, drive shaft assembly, and protective relay
- Function check



### Preparation is the key

Being prepared makes all the difference in a successful maintenance intervention. It saves time and costs. To make sure of a time and cost effective maintenance, simply use our checklists which cover all circumstances - depending on how our specialists come to you. Although usually traveling by plane, within Germany and the neighboring countries our specialists might arrive in a service vehicle. This vehicle is a regular 'shop on wheels' equipped even for full-service interventions! All you have to do is open the transformer station and disconnect your transformer. And leave the rest to our specialists. Completely. Sounds interesting? Our homepage will tell you more!



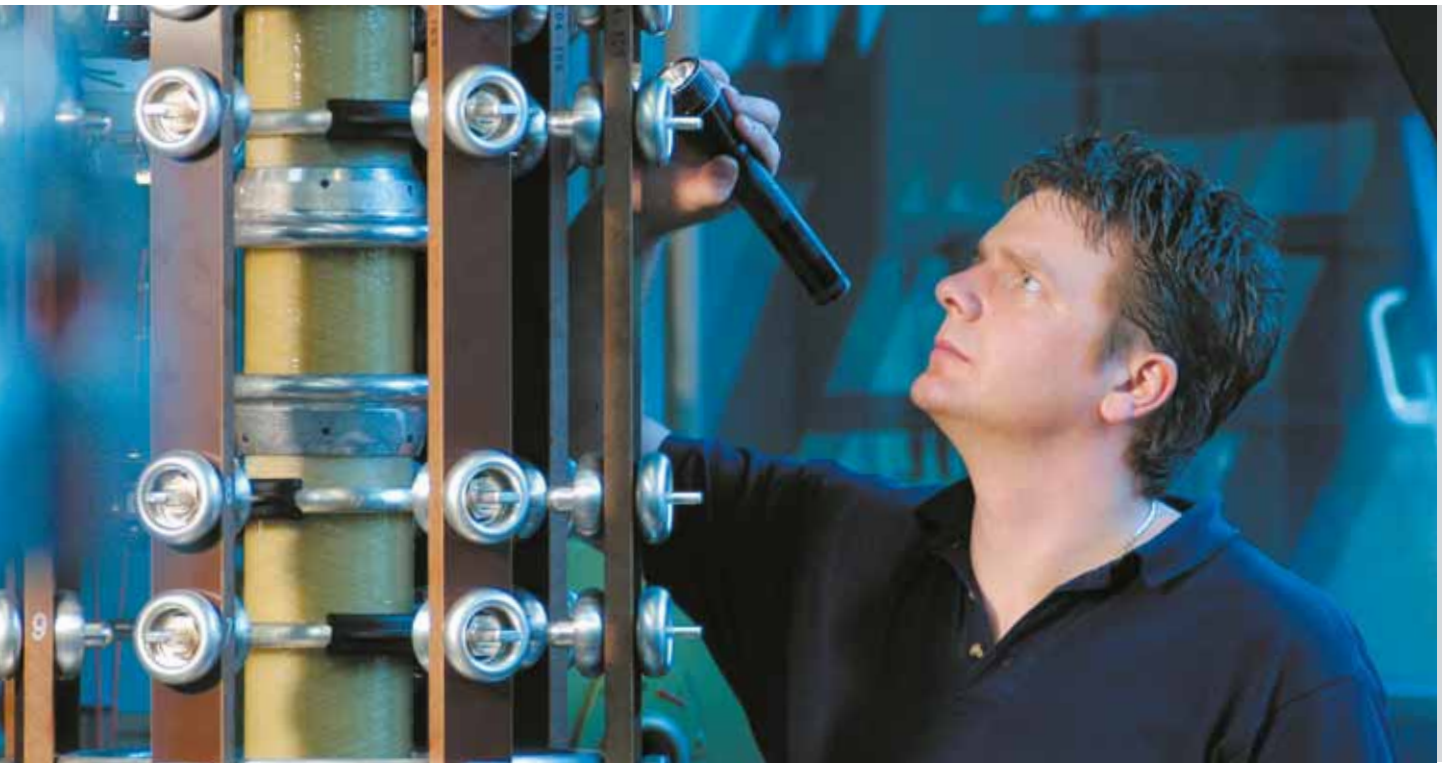
### 'Old' as good as 'new'

There are times when a maintenance right on site is either not possible or simply too time- and labor-consuming. If you need to have major repair work done, our well-equipped service shop in Regensburg may be just the right answer for you. In our shop we also manufacture components for old model OLTCs upon customer request. It goes without saying that all parts are thoroughly quality tested prior to shipment. At our main facility we have more than 15,000 different spare parts on stock which in emergencies can be quickly shipped to just about any place in the world.





# A life insurance for on-load tap-changers



## The OILTAP® maintenance intervals

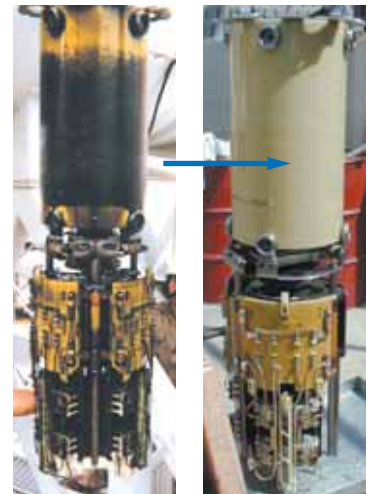
As an independent manufacturer of on-load tap-changers we are here to assist you in the optimized maintenance of your equipment. Optimized maintenance means minimum life cycle costs at maximum system availability. To meet this challenge, we use time-tested as well as innovative methods.

Based on our decades of experience, we recommend specific maintenance intervals for our OILTAP® tap-changers, which can be found in the related user manuals.

In simple terms, these maintenance intervals take into account the following factors:

- The wear and tear of the mechanical components such as e.g. the energy accumulator springs, the number of tap-change operations being the decisive factor.
- Carbon formation in the insulation oil caused by arcing, the number of tap-change operations being as significant a factor as the occurring load currents.
- Contact wear, respectively the difference of wear between the main switching contacts and the transition contacts.
- The dielectric strength of the insulation oil inside the OLTC.

Technology advances. That's why we offer you ongoing update measures. By installing new components during maintenance interventions we can bring your equipment up to date on the spot.





#### The OLTC with a memory: TAPGUARD®

To meet the special requirements of OILTAP® on-load tap-changers (switching in oil), we have developed the innovative **TAPGUARD® Equipment Monitoring System** which can be easily installed in the OLTC's motor drive. It registers load current, tap position, and oil filter data, if applicable. The TAPGUARD® 240 uses complex background algorithms based on our more than 75 years of experience in the field of OLTCs to determine such factors as e.g. contact wear. It clearly shows service recommendations and predicts the next maintenance of your OILTAP®-OLTC. The information thus obtained is the perfect basis for optimized service intervention scheduling and allows you a significant extension of the maintenance intervals.

By the way: TAPGUARD® 240 is the perfect retrofit solution for any application. For instance installed in the motor drive unit ED together with the TAPCON® 240 voltage regulator. If you still have older type OLTCs in use, we'll be glad to retrofit them for you.

For further information, please see our related documents or our homepage.







#### Formula V – as in VACUTAP®

Our development of the vacuum switching technology incorporates the sum total of our decades of combined practical experience and know-how. You'll find that your investment in a VACUTAP® on-load tap-changer will be worth every penny spent - many times over: These tap-changers are maintenance-free for up to 300,000 tap-change operations, which translates directly into dramatic cost reductions. Find out more about the benefits of vacuum technology in our VACUTAP® publications available for downloading under [www.reinhausen.com](http://www.reinhausen.com).

#### Make your problems ours!

We are always on the lookout for better solutions. Just one fine example of what our engineers came up with to tackle a specific problem: MTräB®, the maintenance-free dehydrating breather developed by our subsidiary Messko. It is the only dehydrating breather in the world which does not need silica gel replacement.

Put us to the test and take advantage of our engineering ingenuity! Perfect solutions can't easily be gotten off the rack – but you can get them from us.



**MTräB®**



# Training you can be proud of



## Professional and fast

Time is precious. Especially in OLTC maintenance. The clock keeps ticking the whole time the transformer is off the net. There is no time for unnecessary steps. Isn't it good just then to have someone to rely on one hundred percent? Such as our service specialists? Or your own personnel expertly trained by MR? Our Regensburg and Guangdong (China) training centers offer sound and well-rounded employee training specifically tailored to your needs and requirements. Training of a quality and depth we are sure is unique worldwide. We will train your experts in proper OLTC maintenance of MR's current and previous production, as well as for models made by Siemens, AEG, and TU. All of our trainers are OLTC specialists with many years of experience abroad. Upon request we'll also be glad to come and train your personnel at your own premises.



# A matter of trust

Every year we perform more than 3,000 service interventions worldwide, working in close cooperation with numerous utilities and industrial companies.

Our service technicians are aware of their responsibility and know that their diligent work often decides the fate of high-value material assets. And our customers know that they are in good hands.

Are you ready to let us convince you?





# Reinhausen Worldwide

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**We're by your side. Wherever you are.**

A single glance on the world map shows it all: We are never far from you. In addition to our subsidiaries, a vast number of service representations is right at your fingertips. They provide you with the qualified help you need for your maintenance issues, including professionally trained personnel and the necessary equipment.

Of course you can also get 'first aid' round the clock under [www.reinhausen.com](http://www.reinhausen.com), where you will find the most important service addresses for more than 200 countries with a single click. And the After Sales Service page tells you all you need to know about OLTC maintenance. If you need quick access to a user manual, a catalog, or any other type of printed information – just help yourself to the Download area.

And our staff is also there to answer your questions personally. You can reach them round the clock under our **Emergency Hotline number +49 941 4090-0.**

Need to send an urgent email?

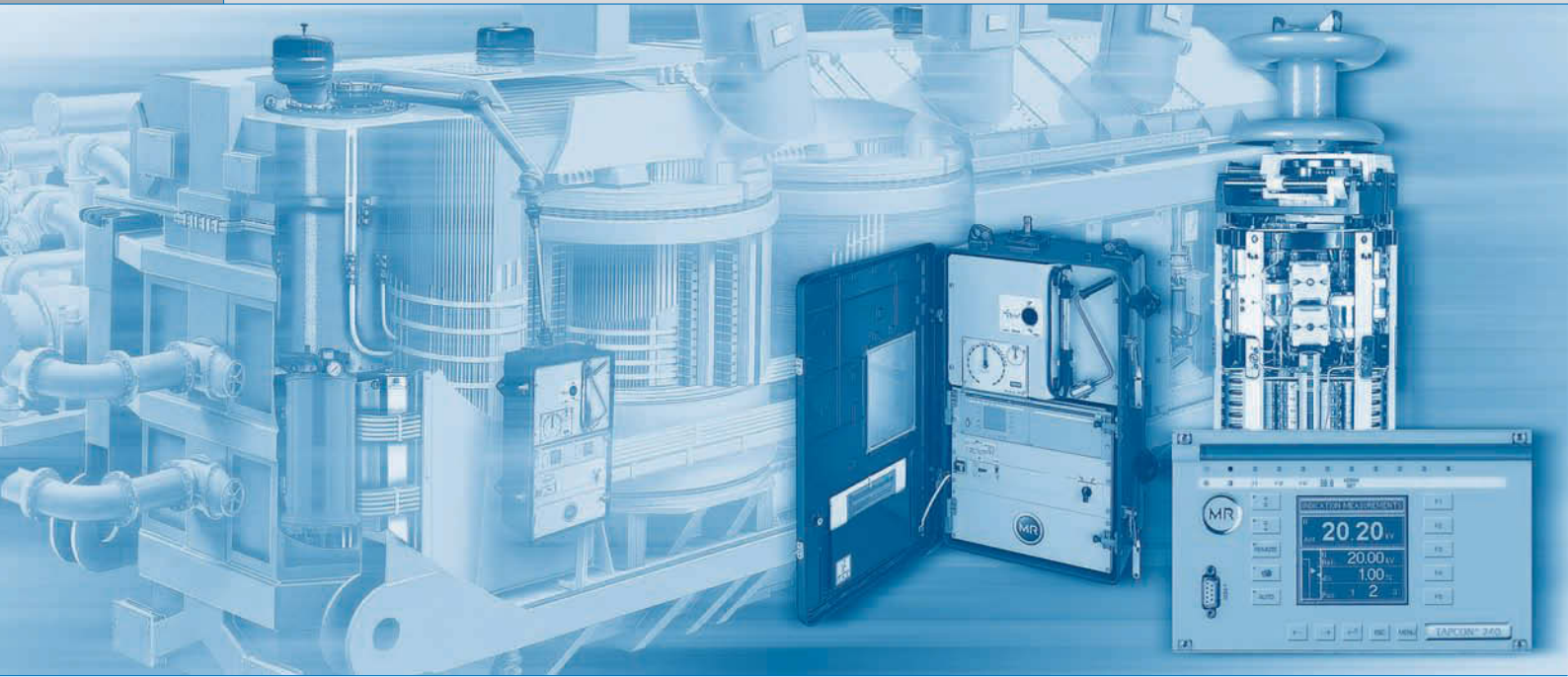
Please write to us at [service@reinhausen.com](mailto:service@reinhausen.com).





# Product Range

Quality without Compromise





## TAPCON® 240/260

**Voltage regulator for highest demands**

Standard 19" rack model.

- Installation in TAPMOTION® ED motor drive possible
- 2 regulators per housing possible

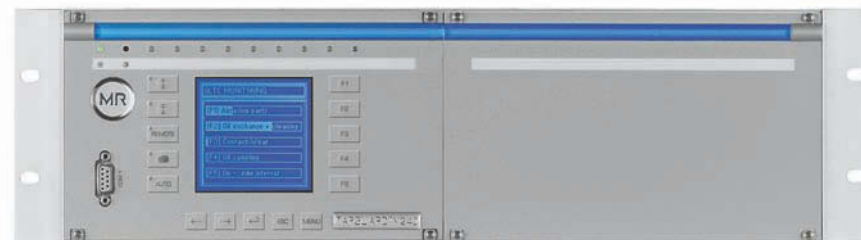
All popular interface protocols available – also compliant to IEC61850.

TAPCON® 240/260 voltage regulators allow parallel control of up to 16 transformers without supplementary equipment. Integration of circuit breakers and isolating switches for simulation of the system configuration can be programmed by customers themselves. The clear, graphic display makes setup very easy.

A wide variety of other options and customer-specific solutions are available for voltage and power flow regulation – just contact our sales specialists.

The performance spectrum includes:

- "TAPCONtrol System" software for parameterization and visualization
- Short-time memory for up to 1000 measured values (standard version)
- Optional 8-MB long-term memory for more than 400 days with separate event memory
- Measuring transducer (optional)
- Serial interface for control system – also available as optical fiber or Ethernet – for all popular protocols
- Freely programmable inputs and outputs – additional functions can also be easily added retroactively
- On-load tap-changer tap position acquisition via BCD, potentiometer or 4...20 mA signal possible



## TAPGUARD® 240/260

**Monitoring – reliability through transparency**

Reduce costs through optimized maintenance of your equipment – an important argument in order to survive in this competitive world. TAPGUARD® from Maschinenfabrik Reinhausen (MR) is now available as an attractive system solution to help reduce costs.

This device was specially developed for the on-load tap-changers from MR. Main

application areas are medium and large power transformers.

TAPGUARD® calculates the primary maintenance criteria of the on-load tap-changer, indicates the current status and the time remaining until the next maintenance.

Monitoring is available as an extra function for TAPCON® 240 or TAPCON® 260.

TAPGUARD® 260 is the successor of the monitoring device TM 100 and contains all functions of the TAPGUARD® 240.

Details on our "transformer cooling controller" including lifespan calculation are available from our sales specialists.



## TAPCON® 230 basic

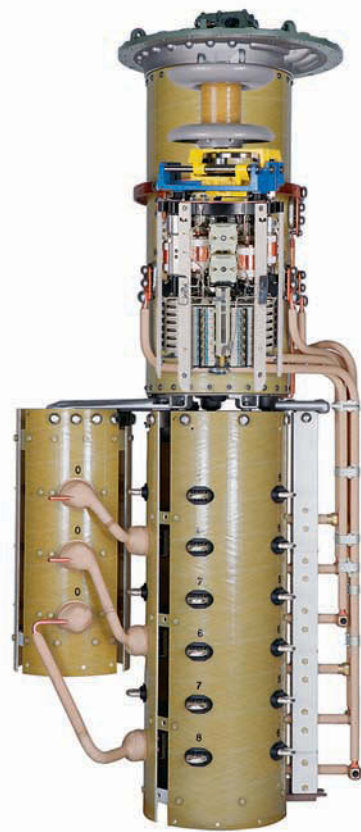
**Automatic voltage regulator – suitable for control board installation or mounting**

The TAPCON® 230 basic voltage regulator handles both – simple control tasks as well as complex requirements of a modern protection and control device. Measurement, control and regulation – one device for all – easy to operate and highly applicable.

- Integrated protection functionalities
- Compensation of voltage drops
- Digital inputs and outputs can be individually programmed on-site
- Multiple individual programmable LED indicators
- Display of all measured or calculated values
- Different selectable operation modes
- Easy Cable connection by using modern plug terminals
- 3 different desired voltage levels adjustable

The TAPGUARD® 260 gets the relevant informations to be able to prevent damages at the OLTC and the transformer from a variety of different measuring devices such as sensors and measuring cards. With TAPGUARD® 260 installed, the assets can be determined and the actual condition of the equipment can be evaluated.





VACUTAP® VRD and VRF

The VACUTAP® VR type family offers a real alternative to the on-load tap-changers from our extensive OILTAP® R/RM and M program. The VACUTAP® VR is the world's first on-load tap-changer which is maintenance-free up to 300,000 switching operations. Since its maintenance is no time-dependent, your transformer has much less downtime.

In addition, you take advantage of the many possible applications of the VACUTAP® VR. It is the first choice for auto transformers, HVDC transformers and many other applications.

Max. rated through-current single-phase/three-phase:	1,300 A
Max. rated step voltage:	4,000 V
Max. rated switching capacity single-phase/three-phase:	3,000 kVA
Highest voltage for equipment U <sub>m</sub> :	72.5–362 kV
Application at neutral point (three-phase) or at any selectable winding position (single-phase up to 2,600 A/6,000 kVA).*	
Operating positions	
Without change-over selector:	18 max.
With change-over selector:	35 max.

VACUTAP® VRC and VRE

Max. rated through-current single-phase:	1,300 A
three-phase:	700 A
Max. rated step voltage:	4,000 V
Max. rated switching capacity single-phase:	3,000 kVA
three-phase:	2,800 kVA
Highest voltage for equipment U <sub>m</sub> :	72.5–300 kV
Application at neutral point (three-phase) or at any selectable winding position.	
Operating positions	
Without change-over selector:	18 max.
With change-over selector:	35 max.
VRC with multiple coarse selector:	107 max.

VACUTAP® VV

The on-load tap-changer VACUTAP® VV already operates throughout the world.

It's maintenance-free up to 300,000 operations and suitable for most network applications. Thus your transformer life-cycle costs are reduced significantly.



A perfect couple:  
VACUTAP® VV  
and transformer

Max. rated through-current single-phase:	400 A
three-phase:	600 A
Max. rated step voltage:	2,000 V
Max. rated switching capacity single-phase/three-phase:	700 kVA
Highest voltage for equipment U <sub>m</sub> :	40–145 kV
Application at neutral point (three-phase) or at any selectable winding position.	
Operating positions	
Without change-over selector:	12 max.
With change-over selector:	23 max.

For more details please see our technical data at [www.reinhausen.com](http://www.reinhausen.com).

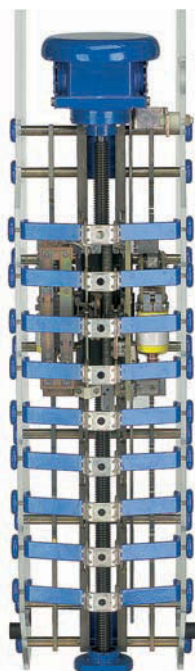
\* Forced current splitting by two parallel winding branches required.



### VACUTAP® AVT

The on-load tap-changer VACUTAP® AVT with vacuum interrupters and integrated motor drive serves as switching element and for setting the ratio of dry-type transformers under load.

Max. rated through-current:	<b>170 A</b>
Max. rated step voltage:	<b>500 V</b>
Max. rated switching capacity:	<b>75 kVA</b>
Highest voltage for equipment $U_m$ :	<b>11.5 kV</b>
Application: At any selectable winding position.	
Operating positions (linear):	<b>9 max.</b>



### VACUTAP® VT

The on-load tap-changer VACUTAP® VT with vacuum interrupters serves for setting the ratio of dry-type transformers under load.

Max. rated through-current single-phase / three-phase:	<b>500 A</b>
Max. rated step voltage:	<b>900 V</b>
Max. rated switching capacity single-phase / three-phase:	<b>250 kVA</b>
Highest voltage for equipment $U_m$ :	<b>40.5 kV</b>
Application: At any selectable winding position.	
Operating positions (linear):	<b>9 max.</b>



### VACUTAP® RMV-II

Our first reactance on-load tap changer with vacuum interrupters and the most impressive performance history since its introduction by the end of the 1980ies. Area of application: primarily North America.

Max. rated through-current three-phase:	<b>2,500 A</b>
Max. rated step voltage (tap-to-tap):	<b>2,000 V</b>
Max. rated switching capacity three-phase:	<b>2,500 kVA</b>
Highest voltage for equipment $U_m$ :	<b>72.5 kV</b>
Application: At any selectable winding position.	
Operating positions	
Without change-over selector:	<b>17 max.</b>
With change-over selector:	<b>33 max.</b>





## OILTAP® V

An exceptionally compact on-load tap-changer for tapped transformers with small to medium output rates.

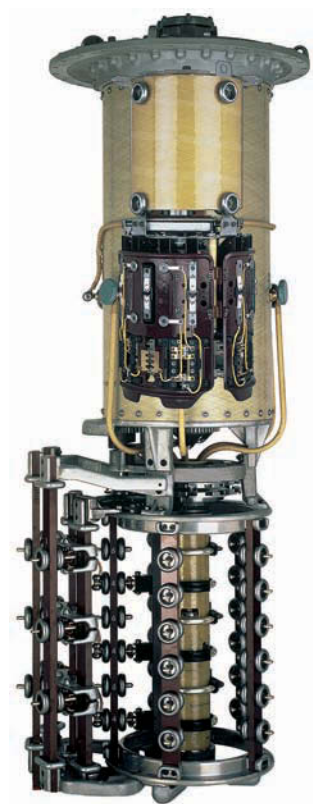
Max. rated through-current:	<b>350 A</b>
Max. rated step voltage:	<b>1,500 V</b>
Max. rated switching capacity:	<b>525 kVA</b>
Highest voltage for equipment $U_m$ :	<b>40–123 kV</b>
Application of the three-phase design: Star point (neutral point) or selectable winding position	
Operating positions	
Without change-over selector:	<b>14 max.</b>
With change-over selector:	<b>27 max.</b>



## OILTAP® MS

A 300A on-load tap-changer for tapped transformers with medium output rates.

Max. rated through-current:	<b>300 A</b>
Max. rated step voltage:	<b>3,300 V</b>
Max. rated switching capacity:	<b>1,000 kVA</b>
Highest voltage for equipment $U_m$ :	<b>72.5–245 kV</b>
Application: Star point (neutral point) Single-phase design at any selectable winding position.	
Operating positions	
Without change-over selector:	<b>14 max.</b>
With change-over selector:	<b>27 max.</b>



## OILTAP® M

The on-load tap-changer allowing the widest and most comprehensive scope of applications: From transformers with medium output rates to large power transformers, process transformers subject to the highest levels of stress, special transformers.

Max. rated through-current	
single-phase:	<b>1,500 A</b>
three-phase:	<b>600 A</b>
Max. rated step voltage:	<b>3,300 V</b>
Max. rated switching capacity	
single-phase:	<b>3,500 kVA</b>
three-phase:	<b>1,500 kVA</b>
Highest voltage for equipment $U_m$ :	<b>72.5–300 kV</b>
Application at neutral point (three-phase) or at any selectable winding position.	
Operating positions	
Without change-over selector:	<b>18 max.</b>
With change-over selector:	<b>35 max.</b>
With multiple coarse selector:	<b>107 max.</b>



### OILTAP® RM

The OILTAP® RM on-load tap-changer is composed of the R diverter switch and the M tap selector.



### OILTAP® R

The on-load tap-changer for the highest voltages and transformer output rates.



### OILTAP® G

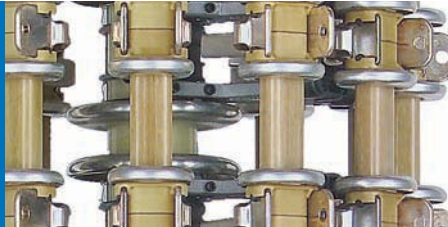
The on-load tap-changer for power transformers with highest capacities.

Max. rated through-current single-phase:	1,500 A
three-phase:	600 A
Max. rated step voltage:	4,000 V
Max. rated switching capacity single-phase:	4,280 kVA
three-phase:	2,400 kVA
Highest voltage for equipment $U_m$ :	72.5 – 300 kV
Application: At the neutral point (three-phase) or as single-phase unit at any selectable winding position up to 1,500 A.	
Operating positions	
Without change-over selector:	18 max.
With change-over selector:	35 max.

Max. rated through-current single-phase:	3,000 A
three-phase:	1,200 A
Max. rated step voltage:	4,000 V
Max. rated switching capacity single-phase:	6,000 kVA
three-phase:	3,000 kVA
Highest voltage for equipment $U_m$ :	72.5 – 362 kV
Application: At the neutral point (three-phase) or as single-phase unit at any selectable winding position up to 3,000 A.	
Operating positions	
Without change-over selector:	18 max.
With change-over selector:	35 max.

Max. rated through-current single-phase / three-phase:	2,000 A
Max. rated step voltage:	5,000 V
Max. rated switching capacity single-phase / three-phase:	5,000 kVA
Highest voltage for equipment $U_m$ :	72.5 – 362 kV
Application: At the neutral point (three-phase) or as single-phase unit at any selectable winding position.	
Operating positions	
Without change-over selector:	18 max.
With change-over selector:	35 max.

Higher max. rated through-currents respectively higher rated switching capacities available on request.



## DEETAP® DU

Off-circuit tap-changers (OCTC) are used for voltage adjustment in oil-immersed transformers. In contrast to on-load tap-changers, off-circuit tap-changers can operate only when the transformer is de-energized.

Max. rated through-current:	<b>2,000 A</b>
Highest voltage for equipment $U_m$ :	<b>245 kV</b>

Higher values as special design on request.



## Accessories



### Oil Filter Unit OF100

- The oil filter plant OF100 can be operated with different filter systems:
  - model with paper filter for cleaning of switching oil
  - model with combination filter cartridge for cleaning and drying of switching oil
- 2 designs for controlling the pump unit:
  - control integrated into separate control cabinet
  - control integrated into the ED motor drive



### Motor Drive TAPMOTION® ED

The motor drive type TAPMOTION® ED is used exclusively for operating on-load tap-changers and off-circuit tap-changers in regulating transformers as well as for operating plunger-core earth-fault neutralizers.

The TAPMOTION® ED motor drive

- has a transparent and modular design (swing frame)
- is innovative: variants with electronic control in connection with tap changer monitoring TAP-GUARD® 260 or voltage regulator TAPCON® 240 inside
- incorporates decades of experience
- is available in two protective housing sizes with the same arrangement of attachment points
  - aluminium cast
  - IP 66



Oil Level Indicators



Mechanical Thermometers and Accessories



Maintenance Free Dehydrating Breather MTrab®



Pressure Relief Device MPreC®



Digital Thermometer MTec®

Messko





